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MP15

OPERATOR'S MANUAL

Electro-Motive Division
La Grange, Illinois

GM

MP15

OPERATOR'S MANUAL

February 1974

SERVICE DEPARTMENT

Electro-Motive Division
La Grange, Illinois
GM

Litho in U.S.A.

NOTICE

The data appearing in this manual is intended as a guide and as an aid in explaining the locomotive equipment used during operation. It is generally applicable to a basic locomotive, that is, a locomotive without optional extra equipment. Some data is also included for a number of the more frequently used extras. When special extra equipment is involved, consult specific drawings or instructions as provided by the railroad.

The information contained in this manual is based on data available when released for printing.

Minor differences encountered in equipment are due to changes made after the manual was sent to press. These changes will be covered in subsequent editions of this manual.

INTRODUCTION

This manual has been prepared to serve as a guide to railroad personnel engaged in the operation of the 1500 horsepower General Motors Model MP15 diesel-electric multipurpose locomotive.

The contents are divided into four sections as follows:

1. General Description - Provides general description of principal equipment components.
2. Cab controls - Explains functions of cab control equipment used in operating the locomotive.
3. Operation - Outlines procedures for operation of the locomotive.
4. Trouble Shooting - Describes probable causes and suggests operator's response to troubles occurring during operation.

A block of page numbers is allocated to each section, Section 1 starting with page 1-1, Section 2 with 2-1 and the others following in this manner. Figures are identified by section and sequence. For example: Fig. 2-3 is the third figure used in Section 2.

To obtain the most benefit from this manual, it is recommended that the sections be read in the sequence in which they appear.

Information pertaining to maintenance, adjustment, and testing is contained in the Locomotive Service Manual. Instructions for testing and maintenance of individual locomotive components are a part of the standard EMD Maintenance Instruction bulletin series.

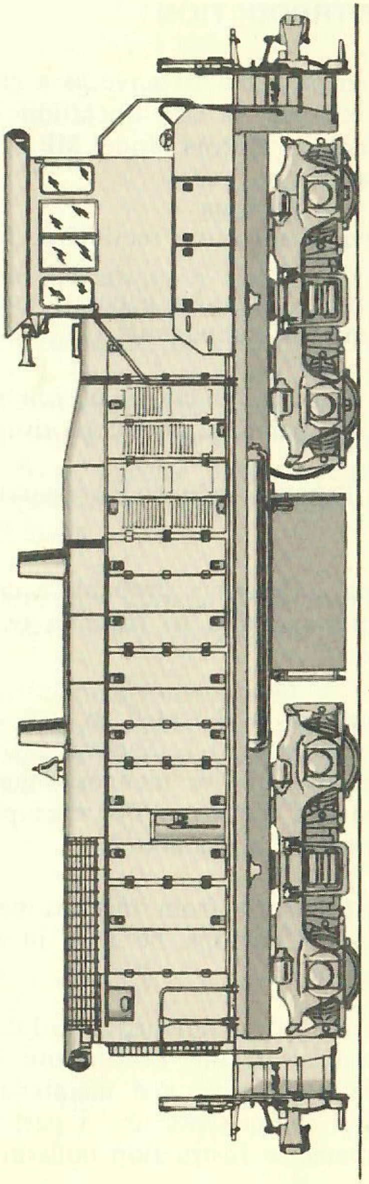

Fig. 0-1 - MP15 Multipurpose Locomotive

GENERAL DATA

Model Designation	MP15
Locomotive Type	0440
Locomotive Horsepower	1500
Diesel Engine	
Model	645E
Number Of Cylinders	12
Cylinder Arrangement	45° - "V"
Cylinder Bore And Stroke	9-1/16" x 10"
Operating Principle	Blower Scavenged 2-Stroke Cycle Unit Fuel Injection Water Cooled
Engine Speed	
Full	900 RPM
Idle	344 RPM
Idle - Switching 2 Mode	505 RPM
Main Generator	D32U
Nominal Voltage DC	600
Auxiliary Generator	
Basic Rating 10 KW	
Voltage DC	74
Traction Motors	
Model	D77
Type	DC, Series Wound, Axle Hung
Driving Wheels	4 Pairs
Diameter	40"
Air Compressor	
Type	Two Stage
Number Of Cylinders	3
Displacement at 900 RPM	254 Cu. Ft./Min.
Lube Oil Capacity	10-1/2 Gal.
Storage Battery	
Number of Cells	32
Voltage	64
Rating - 8 Hour	284 Ampere Hour

Supplies	
Lubricating Oil Capacity	165 Gal.
Cooling Water Capacity	230 Gal.
Sand Basic	30 Cu. Ft.
Special	40 Cu. Ft.
Fuel	
Basic	1100 Gal.
Special	1400 Gal.
Major Dimensions	
Track Gauge	4' 8-1/2"
Distance Between Coupler Pulling Faces	47' 8"
Maximum Height Over Rail	15' 0"
Maximum Width Over	
Flag Brackets	10' 6-5/16"
Underframe	10' 0-3/4"

Curve Negotiation

Truck swing limits single unit curve negotiation to a 60° or 100 ft. radius curve.

Two units coupled are limited by footboard clearance to a 34° or 171 ft. radius curve.

Locomotive coupled to 50 ft. car is limited by coupler swing to a 29° or 200 ft. radius curve.

TABLE OF NOMINAL SPEEDS

Gear Ratio	Minimum Continuous Speed At Full Power	Maximum Speed	Maximum Speed At Which Full Power Is Available	
			Basic No Shunt	1 Step Shunt
62:15	9.3	65*	21.5	41.5

*Based on rated RPM of traction motors.

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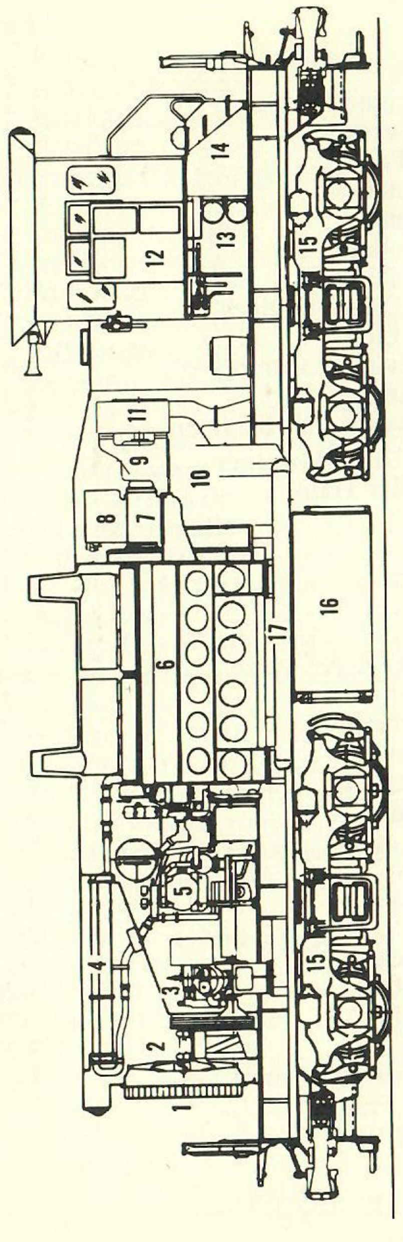

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15. Truck
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Fig. 1-1 – MP15 Locomotive General Arrangement

SECTION 1

GENERAL DESCRIPTION

INTRODUCTION

The General Motors multi-purpose locomotive is equipped with Model 645E diesel engine that delivers power to the main generator for tractive purposes. This power is then distributed to four traction motors, each of which is directly geared to a pair of driving wheels.

Basically the locomotive is designed for single unit operation, but on special order it can be equipped for multiple unit operation. When locomotives are equipped for multiple unit operation they may be operated independently or coupled with other units to form a consist. When equipped and coupled together for multiple unit operation, all units are simultaneously controlled through jumper cables from the control station located in the cab of the lead unit. The end-to-end arrangement of units in a consist in no way affects operation.

The hood end of the locomotive is considered the front end, and the operator's controls are appropriately located. However, on special order, the control console can be equipped with two sets of controls, a master set and a slave set, one on either side of the centrally located control console. The arrangement allows the operator to change positions in the cab in order to obtain maximum visibility in all directions.

The slave controls and the master controls are mechanically coupled, so that when one set is operated, the other set follows. The operator may change positions at the control console without changing the setting of the operator's controls.

The Model MP15 locomotive is illustrated in Fig. 0-1 and the general arrangement of its equipment is shown in Fig. 1-1. Some of the equipment components are numbered and identified in the general arrangement drawing. Some of the items are described in detail in other sections of this manual. The Table Of Contents should be consulted for locations of such information.

HOW THE LOCOMOTIVE OPERATES

1. The fuel pump is driven by an electric motor which, for fuel priming, uses current from the storage battery. Once the engine is started and running, the fuel pump motor uses current directly from the auxiliary generator. The fuel pump transfers fuel from the fuel tank under the locomotive to the engine injectors.

2. The diesel engine is started by means of the direct coupled main generator which is temporarily used as a starting motor. A storage battery supplies the electric current to rotate the generator and start the engine.

3. When the engine is running, it supplies mechanical power through shafts and couplings to directly drive two electrical generators, the air compressor, a traction motor and generator blower, and engine mounted lube oil and cooling water pumps. The radiator cooling fan is driven by sheaves and belts powered through the air compressor shaft.

4. The auxiliary generator charges the storage battery and supplies low voltage direct current for the control, lighting, and main generator excitation circuits. The main generator supplies high voltage direct current to the traction motors for locomotive pulling power.

5. By means of the cab controls, low voltage circuits are established to actuate the engine governor and electrical switchgear.

6. Four traction motors are located under the locomotive. Each traction motor is directly geared to an axle and pair of driving wheels. These motors are located in two trucks which support the locomotive weight and distribute it to the driving wheels.

7. The main generator converts the engine's mechanical power to electrical power, which is then distributed to the traction motors through circuits established by various switchgear components.

8. The throttle electrically controls speed and power by actuating a speed governor mounted on the engine and by stepping up main generator excitation and output as the throttle is advanced. From a standing start in the switching mode a specific tractive effort is immediately available for each operating notch of the throttle. In the series and road modes of operation this specific effort is modulated by the load regulator.

9. At moderate and high operating speeds a load regulator automatically maintains power output at a level consistent with engine speed.

10. The air compressor supplies, to the reservoirs, air under pressure used primarily for the air brakes. The air brakes are controlled by the operator through suitable equipment in the cab.

11. Except for manual operation of the cab controls, locomotive operation is completely automatic. Various alarms and safety devices will alert the operator should any operating difficulties occur.

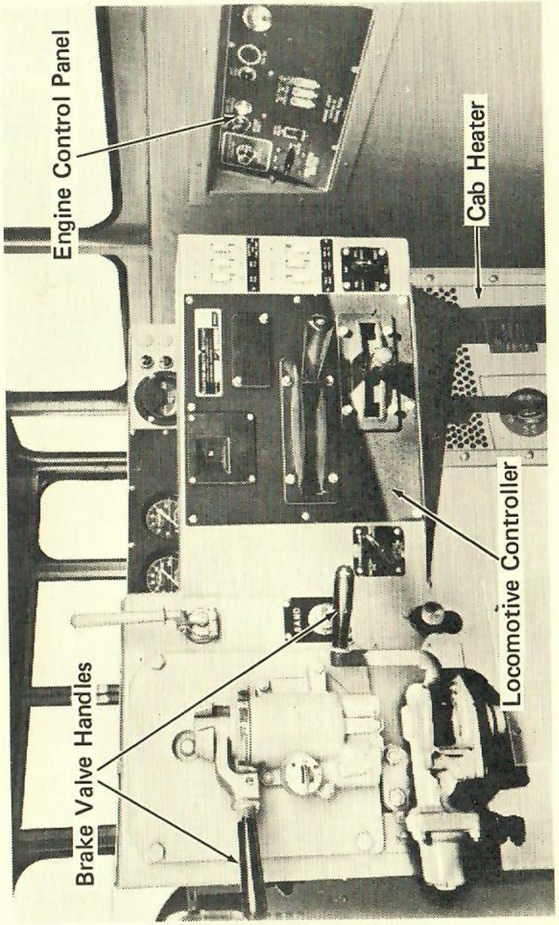


Fig. 2-0 – Locomotive Control Station

SECTION 2

ENGINE STARTING AND CAB CONTROLS

INTRODUCTION

A switch for fuel priming and engine cranking is located at the equipment rack in the engineroom. All other basic control equipment used during locomotive operation is located within the cab, Fig. 2-0.

1. The Switch And Fuse Panel
2. Circuit Breaker Panel
3. The Engine Control Panel
4. The Locomotive Control Console

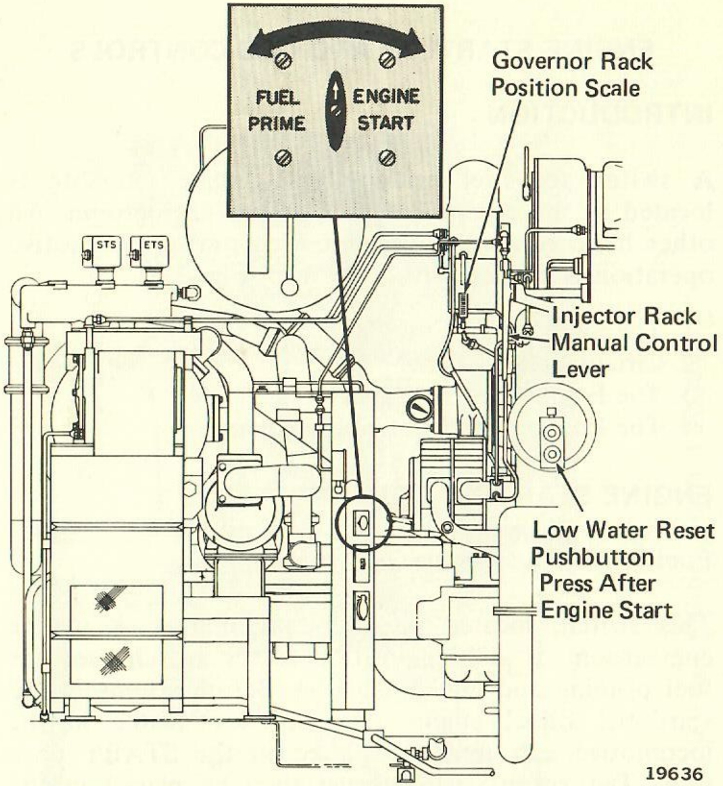
ENGINE STARTING CONTROLS, Fig. 2-1

Fuel Prime And Engine Start Switch

This switch, located on the equipment rack in the engineroom, is a three-position rotary switch used for fuel priming and engine starting. Before attempting to start the diesel engine, the isolation switch in the locomotive cab must be placed in the START position. The rotary switch must then be placed in the FUEL PRIME position and held there for 10 to 15 seconds to operate the fuel pump. The injector rack manual control lever must then be positioned and the rotary switch placed in the ENGINE START position and held (for no longer than 20 seconds) until the engine starts.

Injector Rack Manual Control Lever

This engine mounted hand-operated lever operates the injector racks. It is used to position the injector racks during engine cranking, thereby providing an immediate supply of fuel to the cylinders.



NOTE: When cranking engine, position the injector rack manual control lever at one third rack (approximately 1.6 on the scale). Do not speed up engine until oil pressure is confirmed.

Fig. 2-1 – Engine Starting Controls

Low Water Reset Pushbutton (When Provided)

Check the low water reset button within 50 seconds after engine start. The low water detector will often trip during engine starting, especially on starting after filling a completely drained system. It may also trip after starting a cold engine or one that has had cooling system pressure released. The detector should be reset

soon after the engine starts and is idling, or else the engine will shut down after a time delay established by the engine governor.

NOTE: If the detector is difficult to reset after engine start, position the injector rack manual control lever to increase engine speed for a short time, then press the reset button. Do not speed up engine until oil pressure is confirmed.

The reset button on some detectors will not latch in when the engine is shut down. If such a condition exists, the detector will probably function correctly if it can be reset after engine start.

SWITCH AND FUSE PANEL

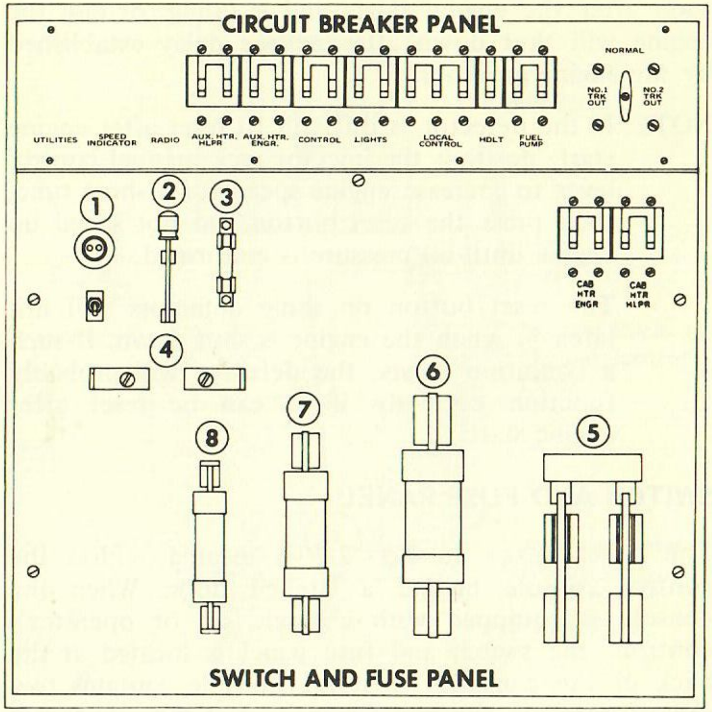
The panel shown in Fig. 2-2 is located within the control console behind a latched door. When the console is equipped with a single set of operator's controls, the switch and fuse panel is located at the back of the console. When the console contains two sets of controls, the panel is located at the side facing the engineroom.

Battery Charging Fuse And Receptacle

As a modification when requested by the railroad, provision is made at the switch and fuse panel for connection of an external source of DC power to charge the locomotive battery. The battery charging fuse is provided to protect the charging circuit.

Auxiliary Generator Field 15 - Ampere Fuse

The field excitation circuit of the auxiliary generator is protected by a 15-ampere fuse. This fuse must be good and in place at all times during locomotive operation. In the event that this fuse is burned out, it stops auxiliary generator output to the low voltage



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1. Fuse Test Light	4. Fuse Test Terminals	7. Auxiliary Generator Fuse
2. Ground Relay Cutout Switch	5. Main Battery Knife Switch	8. Generator Field Fuse
3. Auxiliary Generator Field Fuse	6. Starting Fuse	

Fig. 2-2 – Switch And Fuse And Circuit Breaker Panel

system and also stops fuel pump operation. The engine will eventually stop from lack of fuel.

Ground Relay Cutout Switch

The purpose of the ground relay cutout switch is to eliminate the ground protective relay from the locomotive circuits during certain shop maintenance inspections.

CAUTION: The ground relay cutout switch must always be kept closed in normal operation, otherwise the protection offered by the ground relay will be nullified and possible serious equipment damage could occur. It may be opened, however, in the event of extreme emergency upon receipt of definite instruction to that effect from a responsible officer of the railroad.

Fuse Test Equipment

To facilitate the testing of fuses, a pair of fuse test blocks, a test light and a test light toggle switch are installed on the fuse panel. Fuses may be readily tested as follows. First, move the toggle switch to the on position to make sure the fuse test light is not burned out. Extinguish the light by moving the toggle switch to the off position. Place a fuse across the test blocks so that the metal ends of the fuse are in firm contact with the blocks. If the fuse is good, the light will come on. If the fuse is burned out, the light will not come on and a new fuse is required.

It is always advisable to test fuses before installing them in their circuits. Always isolate the circuits in question by opening their switches before changing or replacing fuses.

Auxiliary Generator Fuse

This fuse connects the auxiliary generator to the low voltage system. It protects against excessive current demands. In the event that the fuse is burned out, it stops auxiliary generator output to the low voltage system and also stops fuel pump operation. The engine will eventually stop from lack of fuel.

Starting 400-Ampere Fuse

The starting fuse is in use only during the period that the diesel engine is actually being started. At this time, battery current flows through the fuse and starting contactor to motor the main generator and crank the engine.

Although this fuse should be in good condition and always left in place, it has no effect on locomotive operation other than for engine starting. A defective fuse can be detected when attempting to start the engine, since at that time (even though the starting contactor closes) the cranking circuit is open.

Main Battery Knife Switch

The large double-pole single-throw knife switch at the lower portion of the fuse panel is the main battery switch. It is used to connect the battery to the locomotive low voltage system and should be kept closed at all times during operation.

If this switch were left open, the fuel pump could not be started, the lights would not function and the engine could not be started. If the switch is opened after the engine has been started, the auxiliary generator will continue to supply the low voltage needs, but the batteries will not receive charge.

This switch may be opened during certain shop maintenance procedures and in instances where the engine is shut down and the locomotive taken out of service for an extended layover. This will prevent the battery from being discharged in the event the lights or other low voltage devices are inadvertently left operating during the layover.

Battery Field 80-Ampere Fuse

The battery field windings of the main generator are excited with current from the locomotive low voltage system. The circuit is established by the battery field contactor BF. The 80-ampere fuse is used in the circuit to protect against possible overload or short circuit damage.

If the fuse is faulty or blown, no alarms will occur, but the locomotive unit will not develop normal power.

CIRCUIT BREAKER PANEL

This panel is located above and forward of the switch and fuse panel, but behind the same cabinet door. It contains the following equipment.

Control 40-Ampere Circuit Breaker

This circuit breaker must be in the on position before locomotive operation is possible. It sets up the fuel pump and control circuits for engine starting. Once the engine is running, power is supplied through this breaker from the auxiliary generator to maintain operating control.

Lights 30-Ampere Circuit Breaker

This circuit breaker must be on to supply power for the individual switches provided for platform, engine room and identification lights.

Local Control 30-Ampere Circuit Breaker

This circuit breaker must be in the on position before operation of the locomotive is possible. During operation it establishes "local" power from the auxiliary generator to operate heavy duty switchgear, and various control devices.

Miscellaneous Circuit Breakers

Circuit breakers can be provided for the headlight, cab heater, safety device, signal light, and radio. The circuit breakers should be placed in the on position to obtain the desired operation.

Fuel Pump Circuit Breaker

The fuel pump circuit breaker must be on for normal operation.

Motor Cutout Switch

This three-position switch is placed in the NORMAL position during normal locomotive operation. The switch is to be placed in the No. 1 or No. 2 TRK. OUT position only in an emergency or if the locomotive is to be run in the maintenance shop.

Do not attempt to move cars with one of the trucks cut out, as serious damage to the electrical equipment may result.

Do not operate at more than one-half throttle with one truck cut out.

WARNING: The wheel slip light burns continuously during operation with one truck cut out. Do not operate with a truck cut out unless it is absolutely certain that all of the wheels are free to rotate.

ENGINE CONTROL PANEL

The engine control panel, Fig. 2-3, is located below the cab front window and on the partition that separates the engineroom from the cab. This panel contains various switches and alarm lights, along with a battery charging indicator or light. Since all of these items will be used at one time or another during operation, a brief description of their individual functions is provided.

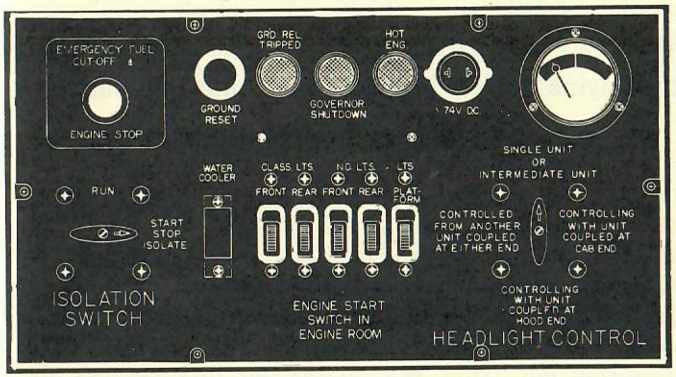
EMERGENCY FUEL
CUT-OFF
ENGINE STOP
GRD REL TRIPPED
HOT ENG.
GROUND RESET
GOVERNOR SHUTDOWN
74V DC
SINGLE UNIT OR INTERMEDIATE UNIT
WATER COOLER
CLASS. LTS.
NO. LTS.
LTS
FRONT REAR FRONT REAR PLAT-FORM
RUN
START STOP ISOLATE
CONTROLLED FROM ANOTHER UNIT COUPLED AT EITHER END
CONTROLLING WITH UNIT COUPLED AT CAB END
CONTROLLING WITH UNIT COUPLED AT HOOD END
ISOLATION SWITCH
ENGINE START SWITCH IN ENGINE ROOM
HEADLIGHT CONTROL

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Fig. 2-3 — Engine Control Panel With Typical Extras

Note that an alarm bell accompanies alarm signal light indications. On units equipped and connected for multiple unit operation, the alarm bell rings in all units of a consist, but the alarm light will come on only in the affected unit.

Ground Relay Tripped Light

The ground relay tripped light indicates an electrical path to ground caused by insulation failure, the presence of water, or an electrical arc. When the light is on, the locomotive will not develop power and the engine will remain at idle.

The light can be put out by pressing the ground relay reset pushbutton after a 10 second pause. It is not necessary to isolate the unit, nor is it necessary to have the throttle in IDLE while pressing the button.

When the ground relay light comes on for the third time after resetting, isolate the affected unit.

CAUTION: Always report ground relay light indications to proper maintenance personnel.

GOVERNOR SHUTDOWN Light

This light comes on when the engine governor has shut the engine down for one of the following reasons.

1. True low oil pressure.
2. Hot engine oil.
3. Low cooling water pressure.
4. Crankcase (oil pan) overpressure.

A mechanism to detect low engine lubricating oil pressure is built into the engine governor. This mechanism is actuated by true oil pressure failure or by dumping oil from the engine oil line leading to the governor. In either event a small button will pop out of the governor body, indicating that the mechanism has tripped the low oil alarm switch. The light on the engine control panel will come on to indicate that the low oil mechanism has tripped.

When a governor shutdown indication occurs, it is necessary to determine whether the crankcase pressure–low water detector has tripped to dump engine oil from the line leading to the governor, or whether a true oil failure has occurred. This can be determined by checking the crankcase pressure–low water detecting device, Fig. 3-2, for protruding reset buttons. A protruding upper button indicates excessive oil pan pressure; a protruding lower button indicates low water.

WARNING: When it is determined that the crankcase pressure detector has tripped, make no further engine room inspections. Do not attempt to restart the engine, Isolate the unit and drain the cooling system in accordance with railroad regulations.

If neither the crankcase pressure nor the low water pressure detector has tripped, and engine oil level is satisfactory with a hot engine condition apparent, do not attempt to restart the engine. Report engine shutdown circumstances to authorized maintenance personnel.

Hot Engine Alarm Light

The hot engine alarm light (red) operates in conjunction with the alarm bell to warn the operator that engine cooling water has reached an excessive temperature. Engine speed and power remain normal, but the engine and water system should be checked if the alarm continues. If the light does not go out in a reasonable length of time, shut the engine down.

If the cooling system has failed and the engine is allowed to run, a hot lubricating oil detector will dump oil from the low oil pressure detector in the engine governor and bring about engine shutdown. There is no other indication for such a shutdown except a very hot engine condition.

WARNING: When low oil shutdown follows a hot engine warning, and a very hot engine condition is observed, make no further engineroom inspections. Do not attempt to restart the engine. Leave the engineroom area, and report circumstances to authorized maintenance personnel.

Emergency Fuel Cutoff And Engine Stop Pushbutton

The switch on the engine control panel is wired in series with emergency fuel cutoff switches located at the fuel filler openings. Pressing any one of the pushbuttons will cause the engine to stop immediately. The switches are spring loaded and do not need to be reset.

The switch operates to stop only the engine in the unit in which the switch is located. In an emergency if it is necessary to stop all engines in a multiple unit consist, pull out on the throttle lever and position it fully to the right; or, if the unit is equipped with a duplex control console, place the special M.U. ENG. STOP switch on the controller in the STOP position.

Ground Relay Reset Pushbutton

The ground relay detects low voltage grounds during engine start and high voltage grounds during operation under power. When it trips, the alarm bells ring in all units of a consist. On the unit affected, generator excitation is lost, the diesel engine goes to idle speed, and the ground relay light on the engine control panel comes on.

To reset the ground relay and restore locomotive power, wait 10 seconds and press the ground reset pushbutton. It is not necessary to isolate the unit or is it necessary to place the throttle in IDLE position before pressing the reset button unless the locomotive is at a standstill.

Repeated resetting of the ground relay is permissible, but instructions as issued by the railroad regarding repeated resetting must be followed. However, in the absence of definite instructions to the contrary, isolate a unit when the ground relay light comes on for the third time after resetting.

CAUTION: Always report ground relay light indications to proper maintenance personnel.

Battery Charging Indicator

With the main battery knife switch closed, the battery charging indicator is connected into the low voltage circuits to indicate the extent of current flowing to and from the storage battery. The indicator does not indicate the output of the auxiliary generator. Since the storage battery is usually well charged, the indicator in normal operation should read zero or slightly in the green area. The pointer should never be in the red area with the diesel engine running, even at idle speed. Such a reading indicates that the battery is discharging, which if allowed to continue could lead to failure of the locomotive unit.

A very strong discharge at time of engine shutdown, followed by blown fuses, indicates a shorted battery charging rectifier. When a very strong discharge is indicated, exercise care before opening the main battery switch.

As an extra modification, a battery charging light may be applied in lieu of the indicator.

Isolation Switch

The isolation switch has two positions, one labeled START/STOP/ISOLATE, the other labeled RUN. The functions of these two positions are as follows:

1. START/STOP/ISOLATE Position

   The isolation switch is placed in this position whenever the diesel engine is to be started. The start switch is effective only when the isolation switch is in this position.

   The START position is also used to isolate the unit, and when isolated the unit will not develop power or respond to the controls. In this event the engine will run at idle speed regardless of throttle position. This position will also silence the alarm bell in the event of a low lube oil alarm. It will not, however, stop the alarm in the event of a hot engine.

2. RUN Position

After the engine has been started, the unit can be placed "on the line" by moving the isolation switch to the RUN position. The unit will then respond to control and will develop power in normal operation.

Miscellaneous Switches

Switches are included in circuits for various lights and devices on the locomotive. The switches are closed as desired to operate the class lights, the number lights, and the platform lights.

Headlight Control Switch

The twin sealed-beam front and rear headlights are controlled by the front and rear headlight switches on the locomotive control panel. A dimming switch is mounted on the right side of the controller. Before these switches will function, the 30-ampere headlight circuit breaker must be placed on.

On locomotives equipped for multiple unit operation, a remote headlight control switch is mounted on the engine control panel. This remote headlight control switch provides for operation of the rear unit headlight from the lead unit. The switch positions are set on each unit as follows:

1. On Lead Unit

If only a single locomotive unit is being used, place the switch in SINGLE UNIT position.

In multiple unit service, if trailing units are coupled to the No. 2 or long hood end of the lead unit, place the switch in the CONTROLLING - COUPLED AT HOOD END position.

In multiple unit service, if trailing units are coupled to the No. 1 or short hood end of the lead unit, place switch in CONTROLLING - COUPLED AT CAB END position.

2. On Intermediate Units

On units operating in between other units in a multiple unit consist, place the switch in the SINGLE UNIT position.

3. On Trailing Units

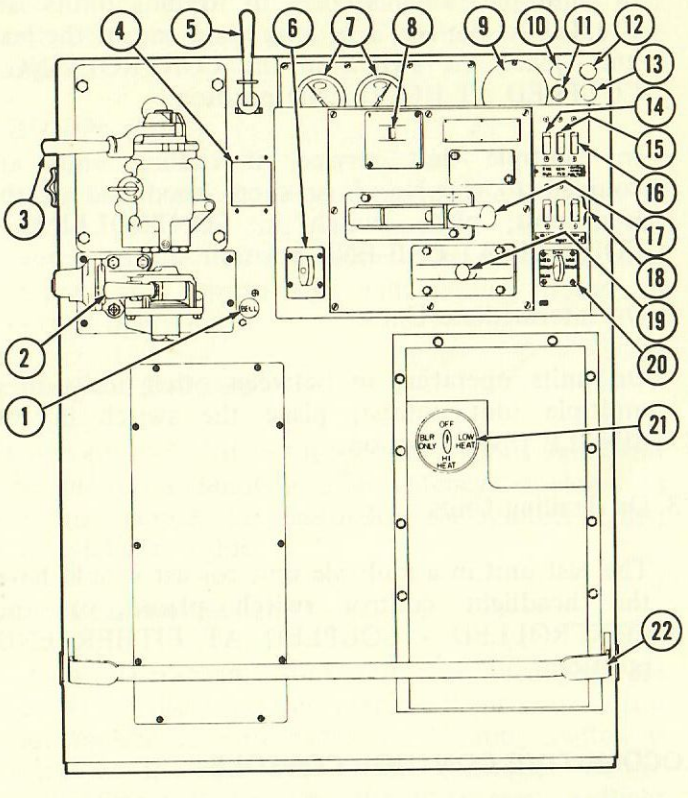
The last unit in a multiple unit consist should have the headlight control switch placed on the CONTROLLED - COUPLED AT EITHER END position.

LOCOMOTIVE CONTROL CONSOLE

Basically the locomotive is equipped with a single set of operator's controls, Fig. 2-4, but on special order a control console containing duplex controls, Figs. 2-5 and 2-6, can be provided. The individual components of the control console together with their functions are described in the following paragraphs.

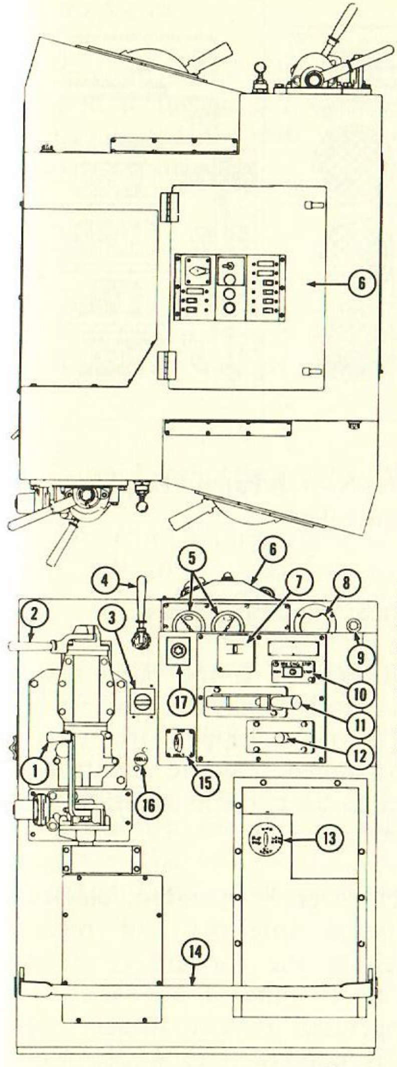
Independent And Automatic Brake Valve Handles

The functions of these handles are more fully described at the end of this section.



1. Bell Ringer Valve
2. Independent Brake Valve Handle
3. Automatic Brake Valve Handle
4. Sanding Switch(es)
5. Air Horn Valve Handle
6. Service Selector Switch
7. Air Brake Gauges
8. Indicating Window
9. Load Current Indicator
10. PCS Open Light
11. Wheel Slip Light
12. Signal Light
13. Sanding Light
14. Engine Run Switch
15. Generator Field Switch
16. Control And Fuel Pump Switch
17. Throttle
18. Miscellaneous Light Switches
19. Reverser Handle
20. Headlight Dimming Switch
21. Heater Fan Switch
22. Safety Control Foot Bar

Fig. 2-4 – Locomotive Controller - Single Operator's Station



1. Independent Brake Valve Handle
2. Automatic Brake Valve Handle
3. Sanding Switch
4. Air Horn Valve Handle
5. Air Brake Gauges
6. Light And Switch Panel
7. Indicating Window
8. Load Current Indicating Meter
9. Control Console Light Dimmer
10. M.U. Engine Stop Switch
11. Throttle Handle
12. Reverser Handle
13. Heater Fan Switch
14. Safety Control Foot Bar
15. Headlight Dimming Switch
16. Bell Ringer Valve
17. Hump Control Rheostat Knob

Fig. 2-5 -- Locomotive Controller - Duplex Operator's Station

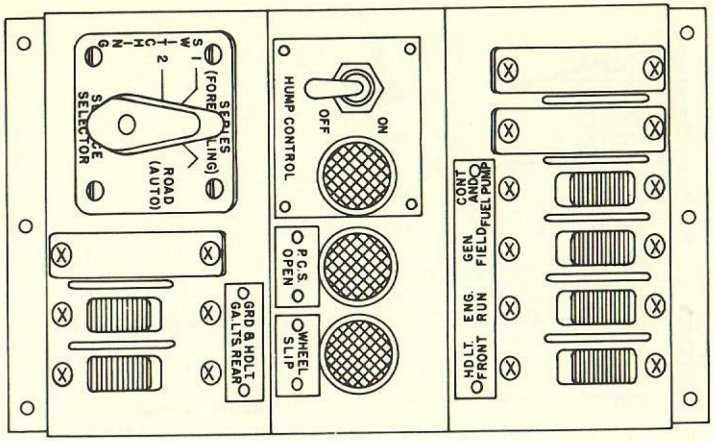


Fig. 2-6 -- Light And Switch Panel - Duplex Controller

Sanding Switches (Electrical Sanding Extras)

Pneumatically controlled sanding is the basic system used, but since the locomotive may be operated in multiple with units that are equipped for electric control of sanding, trainlined electric control of sanding may be provided as an extra in addition to or instead of pneumatic control.

When the sanding switch lever is operated, electrical energy is directed through interlocks of reverser switchgear to operate either the forward or reverse sanding magnet valves in all units of a consist. The basic switch may be operated in any direction for correct sanding and it is non-latching. A directional sanding switch may be provided as an optional extra, and the switch may be latching if requested by the railroad.

Air Horn Valve

The basic air horn valve is actuated by a pull cord connected to the control console. As an optional extra a lever operated air horn valve may be applied to the locomotive controller.

Air Gauges

Air gauges to indicate main reservoir air pressure as well as various pressures concerned with the air brakes are prominently located along the top of the controller.

Load Current Indicating Meter (When Provided)

The locomotive pulling force is indicated by the load current indicating meter located at the upper portion of the controller. This meter is graduated to read amperes of electrical current, with 1500 being the maximum reading on the scale. On special order the meter may be color coded to indicate operating time limits at various meter pointer positions.

The meter is connected so as to indicate the current flowing through the No. 2 traction motor. Since the amperage is the same in all motors, each motor will carry the amount shown on the meter.

Indicating Lights

A wheel slip indicating light is provided on the basic switcher locomotive; however, three other indicating lights may be provided as extras. These may be the PCS Open light, the Sand light, a signal light of optional use, or a hump control light.

1. Wheel Slip Light

Intermittent flashing of the wheel slip light indicates that the wheel slip control system is doing its job and is correcting the slips. The throttle and locomotive power should not be reduced unless severe lurching threatens to break the train.

WARNING: A wheel slip light flashing slowly and persistently may indicate a pair of sliding wheels or circuit difficulty. Stop the locomotive and make a careful inspection to ascertain that there are no locked sliding wheels.

2. PCS Open Light

The PCS or pneumatic control switch functions to automatically reduce locomotive power in the event that an emergency of safety control air brake application occurs. It does so by reducing the speed of all engines to idle.

CAUTION: The engine run switch should be in the off position in all trailing units, or (depending on the type and position of locomotives in the consist) it is possible that the PCS switch of the lead unit will not act to reduce engine speeds to idle.

When the switch is tripped, the PCS Open indicating light on the controller will come on. This light is extinguished and locomotive power restored by resetting the PCS switch. This occurs automatically, provided that:

a. Control of the air brake is recovered.

b. The throttle is returned to IDLE position.

3. Sand Light

This extra light indicates that the manual sanding switch is positioned.

4. Signal Light

This extra light provides a signal as desired by the individual railroad.

5. Hump Control Light

This extra light provides indication that the hump control switch is positioned to activate the hump control circuits.

Operating Switches

A group of switches is located along the front face of the controller, each identified by a name plate indicating switch function. The switches are in the on position when moved upward.

Before the engine is to be started, the control and fuel pump switch must be placed on. To obtain power from the locomotive, the generator field switch must be on. To obtain control of engine speed, the engine run switch must be on. These three important switches are grouped at the right side of the controller. They must be placed in the off position on controllers of trailing units.

Other switches control various lights. They are placed on as needed.

Headlight Dimming Switch

A five position switch is located on the controller next to the reverser handle. In one position it provides for dim headlights on both ends of the locomotive. In the other positions it provides for a bright or medium headlight at either the front or the rear of the locomotive.

For this switch to function, the two headlight switches on the controller as well as the headlight circuit breaker on the switch and fuse panel must be placed on.

Hump Control Rheostat (When Applied)

This rheostat provides finer control of power than the throttle notches are able to give. It is used in combination with the throttle to obtain precise control.

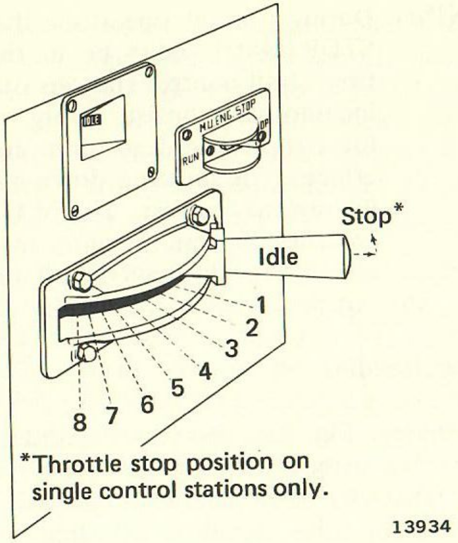
Heater Switch

The engineer's heater and the helper's heater are controlled by a four position switch. The four positions are (1) OFF, (2) LOW HEAT, (3) HI HEAT, and (4) BLOWER ONLY. Circuit breakers for the heaters are located on the circuit breaker panel and the fuse and switch panel.

Throttle Handle

The throttle, Fig. 2-7, actuates switches within the controller to establish low voltage electrical circuits to the engine governor and to related auxiliary relays for purposes of controlling engine speed and power. Each running notch on the throttle increases engine speed about 85 RPM, starting at IDLE and No. 1 positions and going to 900 RPM at full throttle.

NOTE: The locomotive engine runs at a low idle speed when at SWITCHING 1, stand-by, or road service operation and run at a fast idle speed when the controls are set up for switching start, in SWITCHING 2 position.



*Throttle stop position on single control stations only.

Fig. 2-7 – Throttle Handle

Each running notch of the throttle increases locomotive power by increasing generator excitation or engine speed or both. The system provides rapid power response at a level consistent with controlled starting.

The basic throttle has ten positions; namely, STOP, IDLE, and running notches 1 through 8 as shown in Fig. 2-7. Each of these positions is shown in the illuminated indicator in the upper left-hand corner of the controller plate.

When the locomotive is equipped with a duplex control console, neither the master nor the slave throttle handle is provided with a STOP position. A separate emergency engine stop switch is located near each throttle lever. These switches, identified as M.U. ENG. STOP, may be used to stop all engines in a consist from the cab of the lead unit.

WARNING: During normal operation the M.U. ENG. STOP switch must be in the RUN position at all control stations of all units in a locomotive consist. Only the switches located in the lead unit are completely effective in shutting down all engines of a locomotive consist. The M.U. ENG. STOP switches in trailing units may act to decrease engine speed in all units, but will not necessarily cause engine shutdown.

Reverser Handle

The reverser, Fig. 2-8, has three unmarked positions that are consistent with the direction of locomotive travel. That is, the handle is moved forward for forward locomotive travel, is centered in the neutral position, and is pulled back for reverse operation. The position of the handle should be changed only when the locomotive is standing still.

With the reverser in neutral position, no power will be developed when the throttle is opened.

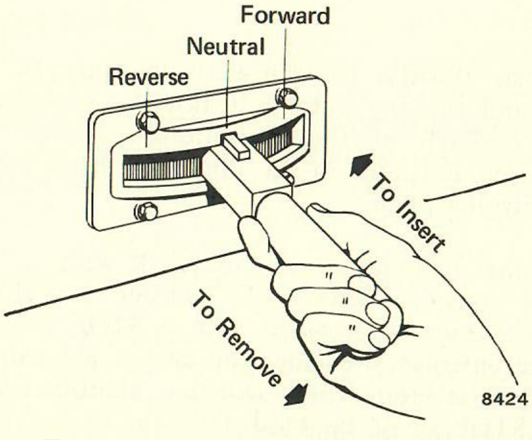


Fig. 2-8 – Reverser Handle Positions

On basic control consoles the reverser handle can be removed from the controller only when the handle is in neutral position and the throttle is in IDLE position. Removal of the reverser handle locks the operating controls in the controller. The reverser handles should be removed from the controllers in all but the lead unit of a multiple unit locomotive consist.

On units equipped with duplex control consoles, the reverser handle can be removed from the master controller when the throttle is placed in IDLE position and the reverser is in neutral position. When the reverser handle is removed from the master controller, an interlock in the mechanism prevents movement of the non-removable handle of the slave controller. The reverser handle should be removed from the master controller in all but the lead cab of a multiple unit consist.

NOTE: The diesel engine runs at normal idle speed when the reverser is centered. When the reverser handle is positioned for operation, the engine will go to fast idle speed if the service selector switch is positioned for switching start, in SWITCHING 2 position.

Indicating Window

Throttle position is indicated in the illuminated indicating window at the upper left corner of the controller plate.

Service Selector Switch

This rotary snap switch is provided to select the type of locomotive service required. The switch has four positions; SWITCHING 1, SWITCHING 2, SERIES (FORESTALLING), and ROAD (AUTO). The functions of the various positions are as follows:

SWITCHING 1 Position

This is the normal position for yard switching. The load regulator is in maximum field position at locomotive start and the generator excitation circuit is set up to provide fast but controlled throttle response for switching operations.

SWITCHING 2 Position

Locomotive operation in the SWITCHING 2 position is the same as in SWITCHING 1 position except that the engine idles faster in SWITCHING 2 position. The faster idle results in faster acceleration. This position may be used when fast acceleration such as for "kicking" cars is desired.

SERIES (FORESTALLING) Position

This switch position is included with the MP15 locomotive even though the motors are connected in permanent series-parallel with the main generator. The reason being that locomotives with transition circuits may operate in multiple with the MP15. In such case, the SERIES position is used in slow speed heavy drag service where series-parallel transition speed is reached so infrequently that changes in motor connection are not desirable.

With the service selector switch in SERIES position, the load regulator is in minimum field position at locomotive start. Throttle response limiting resistance in the generator field excitation circuit is modulated by the load regulator. This provides smooth application of power for a softer start in road service. If MP15 locomotives are operating in consist or independently, the SERIES and the ROAD positions have the same effect.

ROAD (AUTO.) Position

The ROAD position is used during moderate and high speed road operation. At locomotive start the load regulator is in minimum field position and throttle response limiting resistance in the generator field excitation circuit is modulated by the load regulator to provide a softer start in road service. If the MP15 is operating in multiple with units that are equipped to make transition, it allows for a change from series to series-parallel on trailing units.

Bell Ringer

When the bell ringer is operated, compressed air is directed to the locomotive warning bell operator.

Safety Control Foot Bar

The foot bar provides deadman control of the locomotive air brakes. If the bar is released during operation of the locomotive, a whistle will sound and after a delay of approximately 10 seconds a safety control application of the brakes will occur. The delay provides sufficient time for an operator to change stations on locomotives equipped with the duplex control console.

MECHANICAL INTERLOCKS ON THE CONTROLLER

The handles on the controller are interlocked so that with:

1. Throttle in IDLE position –

   Reverser handle can be moved to any position and removed from the controller when the handle is centered.

2. Throttle handle in position 1 through 8 –

   Reverser handle position cannot be changed.

3. Throttle handle in STOP position –

   Reverser handle can be moved to any position, but cannot be removed from the controller.

NOTE: On control consoles equipped with duplex controls, there is no STOP position of the throttle. Emergency engine stop switches are located next to the throttle handles on the controllers.

4. Reverser handle in forward or reverse position –

   Throttle handle can be moved to any position.

5. Reverser handle in neutral position –

   Throttle handle can be moved to any position.

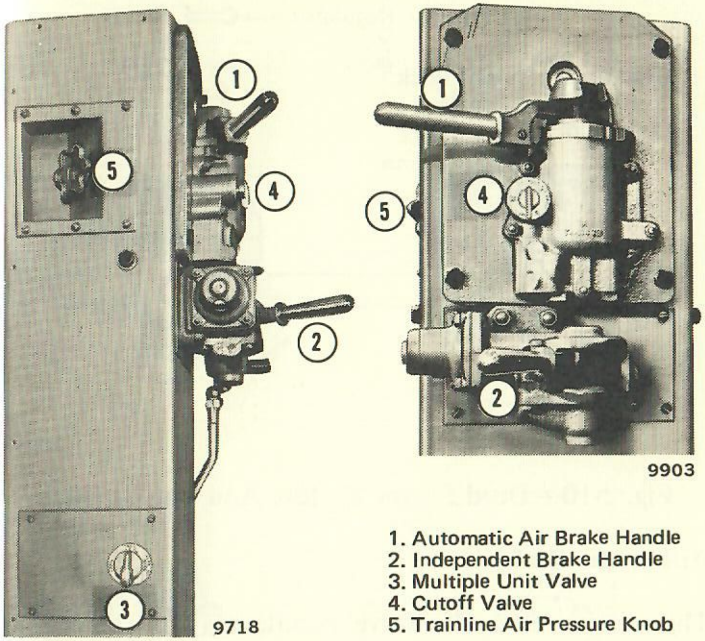
6. Reverser handle removed from controller –

   Throttle handle cannot be moved.

NOTE: On units equipped with duplex control consoles, removal of the reverser handle from the master controller locks the reverser lever of the slave controller in neutral position.

AIR BRAKE EQUIPMENT

Basic locomotives are equipped with type 26NL air brakes. Since type 26NL is standard equipment, only that type of air brake will be discussed in this manual.



1. Automatic Air Brake Handle
2. Independent Brake Handle
3. Multiple Unit Valve
4. Cutoff Valve
5. Trainline Air Pressure Knob

Fig. 2-9 – 26NL Air Brake Control Equipment

The 26NL air brake control equipment is located to the left of the controller. As shown in Fig. 2-9, this equipment consists of an automatic brake, independent brake, multiple unit valve (when MU control is installed), cutoff valve and a trainline air pressure adjustment device. The dead engine fixture, a part of the 26NL equipment is shown in Fig. 2-10. The cock is accessible from outside the locomotive through side door provided.

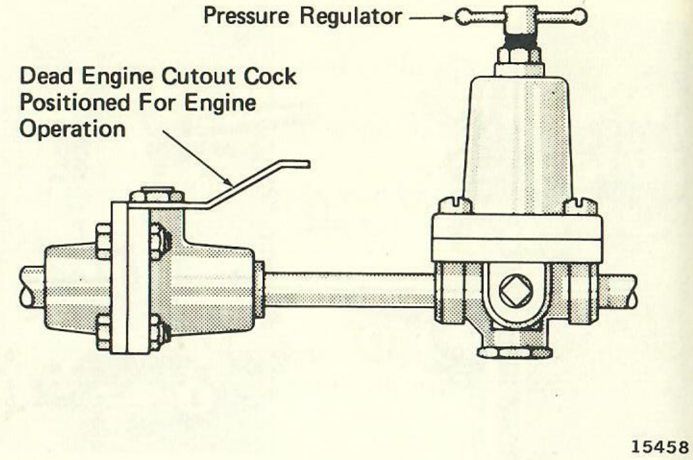

Pressure Regulator
Dead Engine Cutout Cock Positioned For Engine Operation
15458

Fig. 2-10 – Dead Engine Fixture And Cutout Cock

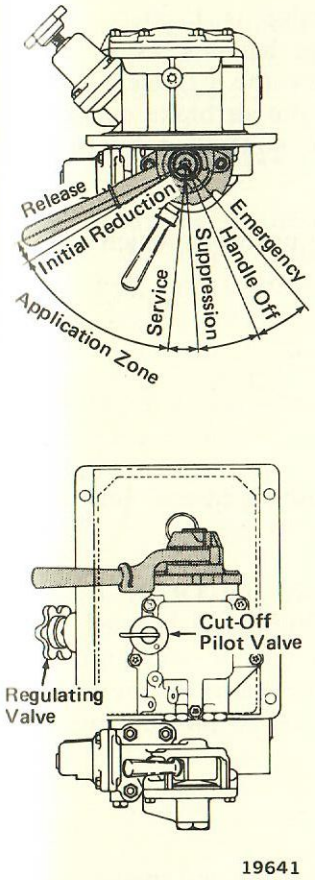
Automatic Brake Valve

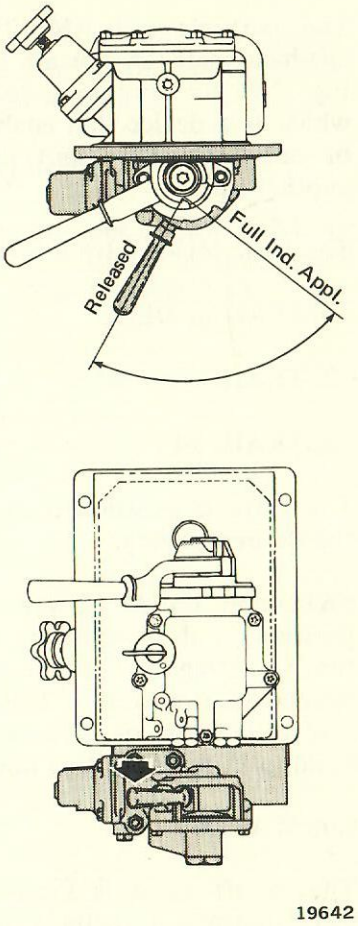
The automatic brake valve handle may be placed in any of six operating positions as shown in Fig. 2-11.

Independent Air Brake, Fig. 2-12

The independent air brake handle is located directly below the automatic brake handle. It has two positions; namely, release and full application. Between these two positions is the application zone. Since this is a self-lapping brake, it automatically laps off the flow of air and maintains brake cylinder pressure corresponding to the position of the handle in the application zone.

Depression of the independent brake valve handle when in the release position causes release of any automatic brake application existing on the locomotive.


Release
Initial Reduction
Application Zone
Service
Suppression
Handle Off
Emergency
Cut-Off Pilot Valve
Regulating Valve
19641


Released
Full Ind. Appl.
19642

Press Lever Down To Release Automatic Application Of Locomotive Brakes

Fig. 2-11 – Automatic Brake Handle Positions

Fig. 2-12 – Independent Brake Handle Positions

Multiple Unit Valve (When Provided)

The multiple unit (MU-2) valve is located on the left-hand side of the air brake handles, as shown in Fig. 2-9. Its purpose is to pilot the F1 selector valve which is a device that enables the air brake equipment of one locomotive unit to be controlled by that of another unit.

The basic MU-2 valve has three positions which are:

1. LEAD or DEAD
2. TRAIL 6 or 26*
3. TRAIL 24

The valve is positioned by pushing in and turning to the desired setting.

*Whenever the MU-2 valve is in the TRAIL 6 or 26 position, and if actuating trainline is not used, then the actuating end connection cutout cock must be opened to atmosphere. This is necessary to prevent the inadvertent loss of air brakes due to possible pressure buildup in the actuating line.

Cutoff Valve

The cutoff valve is located on the automatic brake valve housing directly beneath the automatic brake valve handle. This valve has the following positions:

1. CUT-OUT
2. CUT-IN

Trainline Pressure Adjustment

The trainline air pressure adjusting knob is located behind the automatic brake valve at the upper portion of the brake pedestal. It is shown in Fig. 2-9.

BRAKE EQUIPMENT POSITIONS

When operating locomotives equipped with 26NL air brakes, the brake equipment should be positioned according to the information given in Fig. 2-13.

Type Of Service	Automatic Brake Valve	Independent Brake Valve	Cutoff Valve	Dead Engine Cutout Cock	26D Control Valve	26F Control Valve	MU2 Valve	Overspeed Cutout Cock	Deadman Cutout Cock	6 NR Dist. Valve
SINGLE LOCOMOTIVE EQUIPMENT										
Lead	Release	Release	Passenger Freight	Closed				Open	Open	
Double Heading	Suppression	Release	Cutout	Closed				Open	Open	
Shipping Dead In Train	Handle Off Position	Release	Cutout	Open	Relief Valve At Control Reservoir 73±2 Lbs.			Closed	Closed	Safety Valve 68 psi Setting
MULTIPLE LOCOMOTIVE EQUIPMENT AND EXTRAS										
Lead	Release	Release	Passenger Freight	Closed		Graduated	Lead	Open	Open	
Trail	Handle Off Position	Release	Cutout	Closed		Graduated Direct	*Trail 6 or 26 Trail 24	Open	Open	
Shipping Dead In Train	Handle Off Position	Release	Cutout	Open	Relief Valve At Control Reservoir 73±2 Lbs.	Direct Release	Dead	Closed	Closed	Safety Valve 68 psi Setting
Double Heading	Handle Off Position	Release	Cutout	Closed		Graduated Direct	Lead	Open	Open	
Dual Control:										
Operative Station	Release	Release	Passenger Freight	Closed		Graduated Direct	Lead	Open	Open	
Non-Operative Station	Handle Off Position	Release	Cutout							

*Whenever the MU2A valve is in "Trail 6 or 26" Position and if the actuating train line is not used, then the actuating end connection cutout cock must be open to atmosphere; so as to prevent the inadvertant loss of air brakes due to possible pressure buildup in the actuating line.

NOTE: By AAR standard all cocks in the brake system except brake pipe and end cocks have handles perpendicular to pipe when open.

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Fig. 2-13 – Brake Equipment Positions

SECTION 3

OPERATION

INTRODUCTION

This section of the manual covers recommended procedures for operation of the locomotive. The procedures are briefly outlined and do not contain detailed explanations of equipment location or function.

The information in this section is arranged in sequence, commencing with inspections in preparation for service, and with instructions for starting the engine, handling a light locomotive, coupling to train, and routine operating phases. The various operating situations and special features are also covered.

PREPARATION FOR SERVICE

GROUND INSPECTION

Check locomotive exterior and running gear for:

1. Leakage of fuel oil, lube oil, water or air.
2. Loose or dragging parts.
3. Proper hose connections between units in multiple.
4. Proper positioning of all angle cocks and shut-off valves.
5. Air cut in to truck brake cylinders.
6. Satisfactory condition of brake shoes.
7. Adequate supply of fuel.

8. Proper installation of control jumper cables between units.

LEAD OR SINGLE UNIT CAB INSPECTION

On the lead or control unit, the control locations described in Section 2 should be checked and the equipment positioned for operation as follows:

Fuse And Switch Panel

1. Main battery switch closed.
2. Ground relay knife switch closed.
3. All fuses installed and in good condition.

Circuit Breaker Panel

1. Control circuit breaker on.
2. Local control circuit breaker on.
3. Fuel pump circuit breaker on.
4. Lights circuit breakers and miscellaneous circuit breakers on as needed.
5. Traction motor cutout switch in NORMAL position.

Engine Control Panel

1. Isolation switch in START position.
2. Headlight control switch in proper position for lead unit operation.

3. Miscellaneous switches and circuit breakers on as required.

Locomotive Controller

The controller switches and operating handles should be positioned as follows:

1. Place control and fuel pump switch in on (up) position.
2. Make sure throttle remains in IDLE position and reverser handle is removed from controller.

NOTE: On duplex controllers only the master controller reverser handle is removable.

3. Service selector switch in position for desired mode of operation; SWITCHING, SERIES, or ROAD.
4. On units with duplex control consoles, make sure that both M.U. ENG. STOP switches are in the RUN position.
5. Lights switches on as required.

Air Brakes -- Type 26NL

1. Insert automatic brake valve handle (if removed) and place in suppression position. This will nullify the application of any safety control equipment used.
2. Insert independent brake valve handle (if removed) and move to full application position.
3. Place cutoff valve in the CUT-IN position.

4. Place MU valve in LEAD position.

ENGINEROOM INSPECTION

The engine can be readily inspected by opening the access doors along the side of the long hood end of the locomotive.

1. Check air compressor for proper lubricating oil supply.
2. Observe for proper water level on tank sight glass.
3. Check all valves for proper positioning.
4. Observe for leakage of fuel oil, lubricating oil, water or air.

ENGINE INSPECTION

The engine should be inspected before as well as after starting. After inspection and engine start, all engineroom doors should be closed and latched securely.

1. Check to see that engine overspeed lever is set, Fig. 3-1.
2. Observe that governor low oil pressure trip plunger, Fig. 3-1, is set and that there is oil visible in the governor sight glass.
3. Observe that the crankcase (oil pan) pressure and low water detector reset buttons, Fig. 3-2, are set (pressed in). If the buttons protrude, press and hold for 5 seconds.
4. Observe that engine top deck, air box and oil pan inspection covers are in place and are securely closed.
5. Check that engine oil is at proper level on the dipstick and that lube oil strainer is full of oil (open square cover).

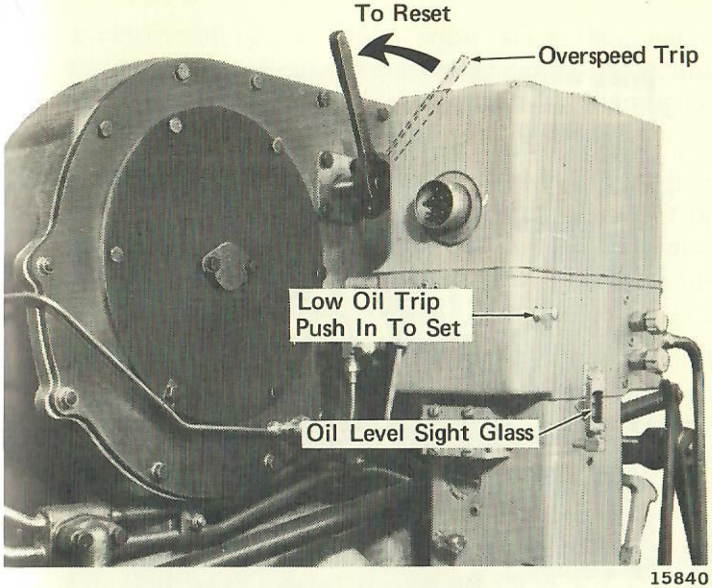

Fig. 3-1 – Engine Overspeed Trip And Low Oil Pressure Trip Plunger

STARTING THE DIESEL ENGINE

After the preceding inspections have been completed, the diesel engine may be started. Starting controls are located at the accessory end of the engine in the area of the equipment rack. See Fig. 2-1.

NOTE: Preheat if engine temperature is less than 30° F.

Perform the following:

1. Open cylinder test cocks and bar over the engine at least one revolution, observe for leakage from test cocks. Close the test cocks.
2. Place the fuel prime/engine start switch in the FUEL PRIME position and hold it there for 10 to 15 seconds to prime the fuel system.

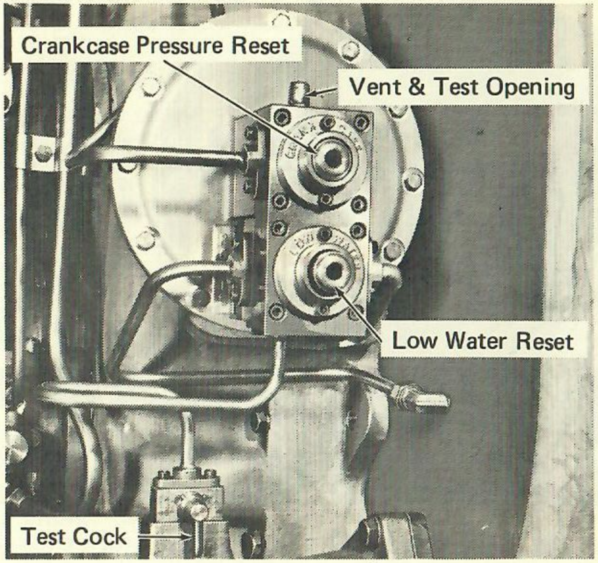

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Fig. 3-2 – Low Water And Crankcase (Oil Pan) Pressure Detector

3. Grasp the injector rack manual control lever and move it so that the pointer at the rack setting indicator on the governor is at about one-third rack (1.6 on the scale). Move the start switch to the ENGINE START position and hold (for not more than 20 seconds) until the engine starts and runs. Release the lever as soon as governor control of injector linkage is felt at the lever.

   Check the low water reset button within 50 seconds after engine start. The low water detector will often trip during engine starting, especially on starting after filling a completely drained system. It may also trip after starting a cold engine or one that has had cooling system pressure released. The detector should be reset soon after the engine starts and is idling, or else the engine will shut down after a time delay established by the engine governor.

NOTE: If the detector is difficult to reset after engine start, position the injector rack manual control lever to increase engine speed for a short time, then press the reset button. Do not speed up the engine until oil pressure is confirmed.

The reset button on some detectors will not latch in when the engine is shut down. If such a condition exists, the detector will probably function correctly if it can be reset after engine start.

   If the alarm bell rings and the ground relay light comes on as the engine cranks, press the ground relay reset pushbutton after the engine has started. Report the presence of a low voltage ground, using routine reporting procedure established by the railroad.

4. Check that engine oil pressure, engine oil level, and governor oil level are satisfactory.

5. Check that the engine cooling water level does not fall below the "LOW" mark on the "Engine Running" portion of the water level gauge plate. If the water level is slightly low, the engine may continue to run at idle speed, but may shut down when the throttle is advanced.

TRAILING UNIT CAB INSPECTION

Switches, circuit breakers and control equipment located in the cab of a trailing unit should be checked for proper positioning as follows:

Fuse And Switch Panel

1. All knife switches closed.
2. All fuses installed and in good condition.

Circuit Breaker Panel

1. Local control circuit breaker on.
2. Control circuit breaker on.
3. Fuel pump circuit breaker on.
4. Lights and miscellaneous circuit breakers on as required.
5. Motor cutout switch in NORMAL position.

Engine Control Panel

1. Isolation switch in START position, and headlight control switch in position to correspond with unit position in consist.
2. Other switches may be placed on as needed or left off, as they do not affect locomotive operation.

Locomotive Controller

The controller switches and operating handles should be positioned as follows:

1. Control and fuel pump switch, generator field switch, and engine run switch must be off.
2. Throttle in IDLE.

3. Reverser handle placed in neutral and then removed from the controller to lock the other handles.

NOTE: On duplex controllers, only the master reverser handle is removable.

4. Service selector switch in ROAD (AUTO) position.
5. On units with duplex control consoles, make sure that both M.U. ENG. STOP switches are in the RUN position.

Air Brakes -- Type 26NL

1. Place automatic brake valve handle in handle-off position. Remove handle (if so equipped).
2. Place independent brake valve handle in full release position. Remove handle (if so equipped).
3. Place MU valve in desired position for trailing unit operation.
4. Place cutoff valve in CUT-OUT position.

STARTING TRAILING UNIT DIESEL ENGINES

Engines in trailing units are started in the same manner as the engine in the lead unit.

PLACING UNITS ON THE LINE

After the diesel engines are started and inspected, units may be placed on the line as desired by placing the isolation switch on the engine control panel in the cab in the RUN position. If the consist is at a standstill, be certain that the throttle handles in all units are in IDLE position before placing any unit on the line.

PRECAUTIONS BEFORE MOVING LOCOMOTIVES

The following points should be carefully checked before attempting to move the locomotive under its own power:

1. Make sure that main reservoir air pressure is normal (approximately 130-140 pounds).

   This is very important, since the locomotive is equipped with electro-magnetic switchgear which will function in response to control and permit operation without air pressure for brakes.

2. Check for proper application and release of air brakes.

3. Release hand brake and remove any blocking under the wheels.

HANDLING LIGHT LOCOMOTIVE

With the engine started and placed "on-the-line" and the preceding inspections and precautions completed, the locomotive is handled as follows:

1. Place the engine run switch and generator field switch in on (up) position.

2. Place headlight and other lights on as needed.

3. Insert reverser handle and move it to desired direction of travel, either forward or reverse.

NOTE: On switcher locomotives, engine speed will increase if the service selector switch is in the SWITCHING 2 position.

4. Place service selector switch in position for type of service desired.

5. Depress safety control foot bar on units so equipped.

6. Release air brakes.

7. Open throttle to position 1, 2, or 3 as needed to move locomotive at desired speed. Locomotive response to throttle movement is almost immediate. There is no delay in power buildup. However, with the service selector switch in SERIES or ROAD position, power is modulated by load regulator position.

CAUTION: Engine should not be operated above throttle position 3 until water temperature is greater than 130° F.

8. Throttle should be in IDLE position before coming to a dead stop.

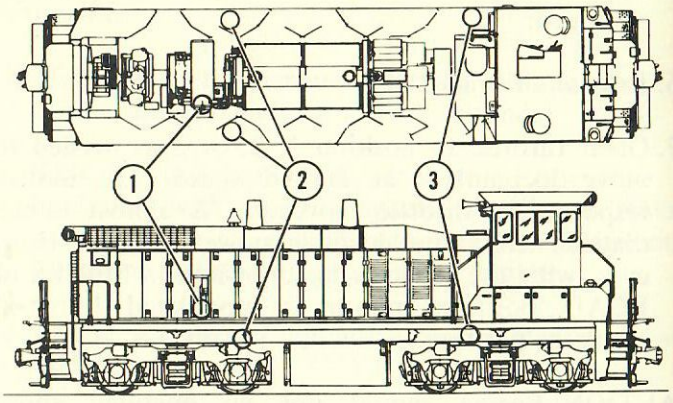
9. Reverser handle should not be moved to change direction of travel until locomotive is completely stopped.

DRAINING OF AIR RESERVOIRS AND STRAINERS

The air reservoirs and air strainers or filters should be drained at least once each day whether or not equipment is provided with automatic drain valves. Draining should be done at the time of crew change until a definite schedule is established by the railroad.

Drain valves should be operated at the following locations:

Momentarily operate the main reservoir, dirt collector, and compressor control strainer drain valves, Fig. 3-3 and 3-4.



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1. Compressor Control Strainer Drain Valve
2. Main Reservoir Drain Valve Locations
3. Main Reservoir Dirt Collector Drain Valve

Fig. 3-3 - Compressed Air System Drain Valve Locations

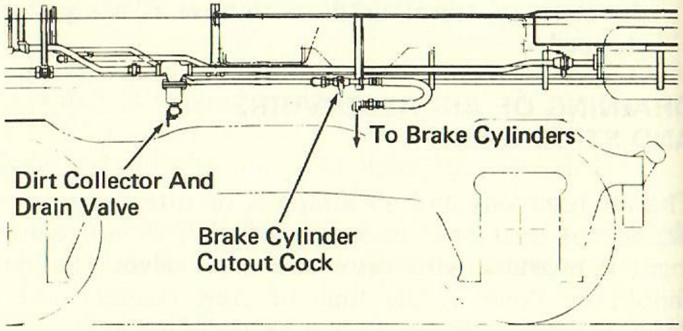

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Fig. 3-4 - Main Reservoir Dirt Collector And Drain Valve

COOLING SYSTEM DRAIN VALVE

The cooling system drain valve is located at the engine sump between the engine and accessory rack. To drain the system, open the valve and allow to remain open until draining is complete. During engine operation, the cooling system drain valve must always be closed.

COUPLING LOCOMOTIVE UNITS TOGETHER

When coupling units together for multiple unit operation, the procedure below should be followed:

1. Couple and stretch units to ensure couplers are locked.

2. Install control cable between units.

NOTE: If the consist is made up with units that are equipped for only pneumatic control of sanding, connect actuating pipes between all units in the consist.

3. Attach platform safety chains between units.

4. Perform ground, engineroom and engine inspections as outlined in preceding articles.

5. Position cab controls for trailing unit operation as outlined in preceding articles.

6. Connect air brake hoses between units as required by the specific equipment involved.

7. Open required air hose cutout cocks on both units.

NOTE: Units with 26NL brake equipment must have the actuating pipe end hose cutout cock closed at the rear of the locomotive when they are leading units with 6SL or 6BL brake equipment. If two or more units of 26NL brake equipment are connected together and leading the consist, the end hoses must be coupled together between units and the cutout cocks on the actuating pipe line opened on each unit. Units with 26NL brake equipment must have the actuating pipe cutout cock open at both ends when attached to, but trailing units with 6SL or 6BL brake equipment. (This is required to eliminate an undesired brake action occurring on the locomotive.)

A setup of the brakes must then be made on the consist to determine if brakes apply on each unit. Brakes then must be released to determine if all brakes release. The same procedure must be followed to check the independent brake application. Also, release an automatic service application by depressing the independent brake valve handle downward. Inspect all brakes in the consist to determine if they are released.

COUPLING LOCOMOTIVE TO TRAIN

Locomotive should be coupled to train using the same care taken when coupling units together. After coupling, make the following checks:

1. Test to see that couplers are locked by stretching connection.

2. Connect air brake hoses.

3. Slowly open air valves on locomotive and train to cut in brakes.

4. Pump up air if necessary, using the following procedure.

PUMPING UP AIR

After cutting in air brakes on train, note the reaction of the main reservoir air gauge. If pressure falls below trainline pressure, pump up air as follows:

1. Place generator field switch in off (down) position.

2. Move reverser handle to neutral position.

NOTE: On MP15 locomotives, a fast idle speed may be obtained by turning the service selector switch to SWITCHING 2 position when reverser handle is positioned for locomotive movement, and the throttle is in IDLE.

3. Open throttle as needed to speed up engine and thus increase air compressor output.

NOTE: Throttle may be advanced to position 4 or 5 if necessary. Engine should not however be run unloaded (as in pumping up air) at speeds beyond throttle position 5.

BRAKE PIPE LEAKAGE TEST

Prior to operating the 26NL brake equipment, a leakage test must be performed. This is accomplished in the following manner.

1. The cutoff valve is moved to the CUT-IN position.

2. Move the automatic brake valve handle gradually into service position until the equalizing reservoir gauge indicates that a 15 psi reduction has been made.

3. Without any further movement of the automatic brake valve handle, observe the brake pipe gauge until this pressure has dropped 15 psi and exhaust has stopped blowing.

4. At this moment turn the cutoff valve to CUT-OUT position. This cuts out the maintaining function of the brake valve.

5. From the instant the cutoff valve is turned to CUT-OUT position, the brake pipe gauge should be observed and any possible drop in brake pipe pressure should be timed for one minute. Brake pipe leakage must not exceed the rate established by railroad rules.

6. After checking trainline leakage for one minute and the results are observed to be within required limits, return the cutoff indicator to the CUT-IN position and proceed to reduce the equalizing gauge pressure until the pressure is the same as brake pipe gauge pressure. This is accomplished by moving the automatic brake valve handle gradually to the right until a full service application has been obtained.

7. After pipe leakage test has been completed, return the automatic brake valve handle to release position.

KICKING CARS

When the service selector switch is placed in SWITCHING position, the load regulator goes to maximum field position and electric circuits operate to relate tractive effort directly to throttle position at locomotive start. The action of the locomotive power control system during switching operations is such that

tractive effort at locomotive start is low in low throttle position and high in high throttle position. This effort is available immediately as the throttle is positioned. It allows sudden but controlled application of power when the throttle is advanced. The rapid application of power gives the locomotive operator a "known" throttle response. The power control at lower throttle positions also simplifies "inching" of cars.

STARTING A TRAIN (SERVICE SELECTOR SWITCH IN SERIES OR ROAD POSITION)

The method to be used in starting a train depends upon many factors such as, the type of locomotive being used; the type, weight and length of the train and amount of slack in the train; as well as the weather, grade and track conditions. Since all of these factors are variable, specific train starting instructions cannot be provided and it will therefore be up to the operator to use good judgment in properly applying the power to suit requirements. There are, however, certain general considerations that should be observed. They are discussed in the following paragraphs.

A basic characteristic of the diesel locomotive is its high starting tractive effort, which makes it imperative that the air brakes be completely released before any attempt is made to start a train.

The locomotive possesses sufficiently high tractive effort to enable it to start most trains without taking slack. The practice of taking slack indiscriminately should thus be avoided. There will, however, be instances in which it is advisable (and sometimes necessary) to take slack in starting a train. Care should be taken in such cases to prevent excessive locomotive acceleration which will cause undue shock to draft gear and couplers, and lading.

Proper handling is important when starting trains, since it has a direct bearing on the power being developed. As the throttle is advanced, a power increase occurs immediately. The strength of the increase is dependent upon throttle position and is modulated by the load regulator.

It is therefore advisable to advance the throttle one notch at a time when starting a train. A train should be started in as low a throttle position as possible, thus keeping the speed of the locomotive at a minimum until all slack has been removed and the train completely stretched. Sometimes it is advisable to reduce the throttle a notch or two at the moment the locomotive begins to move in order to prevent stretching slack too quickly or to avoid slipping.

When ready to start, the following general procedure is recommended:

1. Place service selector switch in position for type of service desired.
2. Move reverser handle to the desired direction, either forward or reverse.
3. Place engine run and generator field switches in the on (up) position.
4. Release both automatic and independent air brakes.
5. Open the throttle one notch every few seconds as follows:
   a. To position 1 – The engine will load. This may be noted on the load current indicator meter. At an easy starting place the locomotive may start the train.

   b. To position 2, 3 or higher (experience and the demands of the schedule will determine this) until the locomotive moves.
6. Reduce throttle one or more notches if acceleration is too rapid.
7. After the train is stretched, advance throttle as desired.

NOTE: When operating at full power to climb a hill, the wheel slip light may indicate frequent slipping. In such case do not reduce throttle unless severe lurching occurs and there is danger of pulling the train apart.

ACCELERATING A TRAIN

After the train has been started, the throttle can be advanced as rapidly as desired to accelerate the train. The speed with which the throttle is advanced depends upon demands of the schedule and the type of locomotive and train involved. In general however, advancing the throttle one notch at a time is desired to prevent slipping.

The load indicating meter provides the best guide for throttle handling when accelerating a train. By observing this meter it will be noted that the pointer moves toward the right (increased amperage) as the throttle is advanced. As soon as the increased power is absorbed, the meter pointer begins moving toward the left. At that time, the throttle may again be advanced. Thus for maximum acceleration without slipping, the throttle should be advanced one notch each time the meter pointer begins moving toward the left until full power is reached in throttle position 8.

Additional train acceleration is provided (on locomotives so equipped) by motor field shunting. These changes take place automatically during throttle changes or after reaching full throttle. The changes in electrical circuits during acceleration take place automatically without any attention or action on the part of the operator.

SLOWING DOWN BECAUSE OF A GRADE

On MP15 units, no changes in motor connection with the main generator occur. Steps of decreasing shunt (on units so equipped) occur automatically and will be indicated by movement of the load current indicating meter pointer. No action is required on the part of the operator.

SW1000 units trailing in a consist may be equipped with D25 generators. Such units may be equipped for transition and shunting. Steps of decreasing shunt will occur automatically, but backward transition (change of motor connection) is not automatic. As the locomotive slows down increased load current may be noted. When load current on the unit approaches 800 amperes, a current limiting relay operates to decrease generator excitation and cause the wheel slip light to come on and go off. The operator may take the following action:

Reduce throttle position to 6 or lower, and after a moment turn the service selector switch to the SERIES position. Reopen the throttle as desired. When the train reaches level or downhill track and increased speed is possible, the service selector switch should be returned to the ROAD position.

If operating conditions are such that a momentary lessening of power is not important, backward transition may be accomplished by placing the throttle in IDLE position, and after a momentary delay reopening it as desired.

AIR BRAKING WITH POWER

The method of handling the air brake equipment is left to the discretion of the individual railroad. However, when braking with power, it must be remembered that for any given throttle position, the draw bar pull rapidly increases as the train speed decreases. This pull might become great enough to part the train unless the throttle is reduced as the train speed decreases. Since the pull of the locomotive is indicated by the amperage on the load meter, the operator can maintain a constant pull on the train during a slow down by keeping a steady amperage on the load meter. This is accomplished by reducing the throttle a notch whenever the amperage starts to increase. It is recommended that the independent brakes be kept fully released during power braking. The throttle must be in IDLE before the locomotives comes to a stop.

OPERATING OVER RAIL CROSSING

When operating the locomotive at speeds exceeding 25 MPH, reduce the throttle to position 4 at least eight seconds before the locomotive reaches a rail crossing. If the locomotive is operating in position 4 or lower, or running less than 25 MPH, allow the same interval and place the throttle in the next lower position. Advance the throttle after all units of the consist have passed over the crossing. This procedure is necessary to ensure decay of motor and generator voltage to a safe level before the mechanical shock that occurs at rail crossings is transmitted to the motor brushes.

RUNNING THROUGH WATER

Under absolutely no circumstances should the locomotive be operated through water deep enough to touch the bottom of the traction motors. Water any deeper than 3" above the rail is likely to cause traction motor damage.

When passing through any water on the rails, exercise every precaution under such circumstances and always go very slowly, never exceeding 2 to 3 MPH.

WHEEL SLIP LIGHT INDICATIONS

The momentary flashing of the wheel slip light on and off generally indicates a pair of wheels are slipping. Corrective wheel slip relay action automatically reduces the power output of the main generator which thereby reduces traction motor torque, stopping the slipping.

In most cases it will be unnecessary to reduce the throttle because of momentary wheel slip action, as the locomotive will automatically reduce its power to stop the slipping, and reapply the power after the slipping has stopped. However, under extreme rail conditions, slipping may occur repeatedly causing the unit to lurch. In such case the throttle should be reduced to a position that will apply the maximum power permissible without causing excessive slipping. Sand should be used to prevent slipping, not to stop it.

On units equipped to operate in multiple, the wheel slip light signal is trainlined. When any unit in a consist slips, the light indication appears in all units of the consist.

If a locomotive consist contains SW1000 units equipped with D25 generators, the wheel slip light is used to indicate that the current limit relay has picked up to limit main generator current. This occurs when locomotive speed decreases after transition has been made. When such wheel slip light indications appear, it is necessary for the operator to manually initiate backward transition, either by changing service selector switch position or by returning the throttle to IDLE position.

LOCOMOTIVE SPEED LIMIT

The maximum speed at which the locomotive can be safely operated is determined by the gear ratio. This ratio is expressed as a double number such as 62:15. The 62 indicates the number of teeth on the axle gear while the 15 represents the number of teeth on the traction motor pinion gear.

Since the two gears are meshed together, it can be seen that for this particular ratio the motor armature turns approximately four times for a single revolution of the driving wheels. The locomotive speed limit is therefore determined by the maximum permissible rotation speed of the motor armature. Exceeding this maximum could result in serious damage to the traction motors.

Various gear ratios are available to suit specific locomotive operating requirements. For each gear ratio, there is a maximum operating speed. This information is given in the "General Data" section at the beginning of this manual.

Although not basically applied, overspeed protective equipment is available for installation on locomotives. The equipment consists of an electro-pneumatic arrangement with many possible variations to suit specific requirements. In general, however, an electrical switch in the speed recorder is used to detect the overspeed. This switch in turn initiates certain air brake functions which reduce the train speed.

HUMP SPEED CONTROL

When applied, the electrical hump speed control circuit controls the positioning of the load regulator, thereby controlling the excitation to the main generator. From this it can be seen that a combination of throttle setting (i.e., engine RPM) and applied voltage (main generator excitation voltage) produces the power to move the train. Locomotive power can be reduced by reducing the throttle setting. However, reducing power in smaller increments better suits the operating conditions peculiar to humping service. Reducing the excitation as the load lessens makes possible a fine balance between power output and power required.

MULTIPLE UNIT OPERATION

Switching locomotives are basically designed for single unit operation, but can be arranged for multiple unit operation.

A locomotive equipped for multiple operation is supplied with the same electro-hydraulic governor control and controller that is supplied on the basic switcher. An isolation switch, stop button, alarm bell, and remote control headlight switch are also provided.

DOUBLE HEADING

Prior to double heading behind another locomotive, make a full service brake pipe reduction with the automatic brake valve, and place the cutoff valve in CUT-OUT position. Return the automatic brake valve handle to the release position and place the independent brake valve in release position. On 26NL equipment place the MU valve in LEAD position.

The operation of the throttle is normal, but the brakes are controlled from the lead locomotive. An emergency air brake application may be made, however, from the automatic brake valve of the second unit. Also, the brakes on this unit may be released by depressing the independent brake valve handle while it is in the release position.

ISOLATING A UNIT

A locomotive unit in a multiple unit consist may be isolated at any time by turning the isolation switch to the ISOLATE position, but discretion as to timing and necessity should be used.

CHANGING OPERATING ENDS

When the locomotive consist includes two or more units with operating controls, the following procedure is recommended in changing from one operating end to the opposite end on locomotives equipped with 26NL brakes.

ON END BEING CUT OUT

1. Move the automatic brake valve handle to service position and make a 20 pound reduction.

2. After brake pipe exhaust stops, place cutoff valve in CUT-OUT position by pushing dial indicator handle in and turning to the desired position.

3. Place independent brake in fully released position.

4. Place MU valve in the desired TRAIL position, depending on brake equipment on trailing units. (MU valve is located in the left hand side of the air pedestal. Push dial indicator inward and turn to desired position.)

5. Position automatic brake valve in handle off position. (Handle may be removed if so equipped.)

6. Place reverser handle in neutral position and remove to lock controller.

NOTE: On units equipped with duplex control consoles, only the master controller reverser handle can be removed.

7. At the controller, place all switches in the off position. Be absolutely certain that the control and fuel pump switch, generator field switch, and engine run switch are in the off position.

8. At the engine control panel, place headlight control switch in proper position for trailing unit operation. Place other switches on as needed.

9. At the circuit breaker panel, the control circuit breaker and the local control circuit breaker remain in the on position.

NOTE: If the local control circuit breaker is inadvertently placed off at this time, the engine will shut down when the trainlined control circuit is re-established. However, the engine may be restarted in the normal manner after placing the local control circuit breaker on.

10. After completing the operations outlined in the preceding steps, move to the cab of the new lead unit.

ON END BEING CUT IN

1. At the controller, make certain throttle lever is in IDLE and the generator field switch is off.

2. Insert reverser handle and leave in neutral position.

3. Insert automatic brake valve handle (if removed) and place in suppression position to nullify any safety control, overspeed, or train control used.

4. Insert independent brake valve handle (if removed) and move handle to full independent application position.

5. Position cutoff valve in the CUT-IN position.

6. Place MU valve in LEAD position.

7. At the circuit breaker panel, check that the control circuit breaker is in the on position. Other circuit breakers remain on.

8. At the engine control panel, place the headlight control switch in proper position, and other switches on as needed.

9. At the controller, place the engine run, control and fuel pump, and generator field switches in on position. Other switches may be placed on as needed.

STOPPING ENGINE

There are six ways to stop the engine.

1. Press stop button on engine control panel.

When the locomotive is standing still or under power, the isolation switch should be placed in STOP position. The stop button can then be pressed in to stop the engine. Since the reaction of the stop button is instantaneous, it need not be held in.

2. Press emergency fuel cutoff button.

   Emergency fuel cutoff pushbuttons are located near each fuel filler opening and on the engine control panel. These pushbuttons operate in the same manner as the stop button and need not be held in or reset.

3. Use injector rack manual control lever.

   This lever at the accessory end of the engine can be operated to override the engine governor and move the injector racks to the no fuel position.

4. Close the low water detector test cock.

   When the low water detector trips, oil is dumped from the governor low oil shutdown device, stopping the engine.

5. Use throttle lever or M.U. ENG. STOP switch.

   a. On units equipped with single control station, move the throttle to IDLE position, pull the handle out and away from the controller, and move it beyond IDLE to the STOP position.

   b. On units equipped with duplex control stations, move throttle to the IDLE position and place the M.U. ENG. STOP switch in the STOP position.

WARNING: The M.U. ENG. STOP switches in the cab of the lead unit will stop all engines in a consist regardless of throttle position, but the M.U. ENG. STOP switches in trailing units will stop all engine only if the throttle in the lead unit is in the IDLE position.

6. Pull out the low oil pressure trip plunger on the side of the governor.

CAUTION: Observe freezing weather precautions whenever an engine is shut down during cold weather.

SECURING LOCOMOTIVE FOR LAYOVER

1. Place the reverser handle in neutral position and the throttle in IDLE.
2. Place isolation switch in START and press stop button.
3. Place all switches on the controller panel in the off position (down).
4. Place all circuit breakers and switches on the circuit breaker panel and the engine control panel in the off position and open all knife switches.
5. Apply hand brake and block wheels, if necessary.
6. Cover exhaust stacks if there is danger of a severe rain.
7. Drain or otherwise protect engine if there is danger of freezing.

TOWING LOCOMOTIVE IN TRAIN

When a locomotive unit equipped with 26NL air brakes is placed within a train consist to be towed, its control and air brake equipment should be set as follows:

1. Drain all air from main reservoirs and air brake equipment unless engine is to remain idling.
2. Place the MU valve in DEAD position.
3. Place cutoff valve in CUT-OUT position.
4. Place independent brake valve handle in release position.
5. Place automatic brake valve handle in handle-off position.
6. Cut in dead engine fixture by turning cutout cock, Fig. 2-10, to open (90° to pipe) position. Dead engine cock is located beneath cab floor and may be reached through an access door at side of locomotive.

CAUTION: The pressure regulator shown in Fig. 2-10 is adjusted at a maintenance point in accordance with the type of brake equipment used. The locomotive operator should not attempt to adjust braking pressure.

7. If engine is to remain idling switches should be positioned as follows:

    a. Isolation switch in START position.

    b. All knife switches closed.

    c. Local control and control circuit breakers on.

    d. Generator field and starting fuses should be removed. Other fuses should be left in place.

    e. Control and fuel pump switch on.

    f. Fuel pump circuit breaker on.

    g. Throttle in IDLE, reverser handle centered. Remove reverser handle from controller to lock controls.

8. If locomotive is to be towed dead in a train, switches should be positioned as follows:

    a. All knife switches open.

    b. All circuit breakers off.

    c. All control switches off.

    d. Starting fuse removed.

    e. Throttle should be in IDLE, and reverser handle should be removed from controller.

NOTE: If there is danger of freezing, the engine cooling system should be drained.

FREEZING WEATHER PRECAUTIONS

As long as the diesel engine is running, the cooling system will be kept adequately warm regardless of ambient (outside) temperatures encountered. It is only when the engine is shut down or stops for any reason that the cooling system requires protection against freezing.

COOLING SYSTEM

FOR NORMAL FILLING - DO NOT REMOVE PRESSURE CAP. ATTACH HOSE AT FILL CONNECTOR AND HOLD FILL VALVE OPEN.

CAUTION — IF PRESSURE CAP MUST BE REMOVED, DO NOT ATTACH HOSE TO FILL PIPE. HOLD FILL VALVE OPEN UNTIL TANK IS COMPLETELY VENTED. THEN REMOVE CAP. WHEN REPLACING, HOLD FILL VALVE OPEN SO CAP CAN BE FULLY TIGHTENED AS SHOWN.

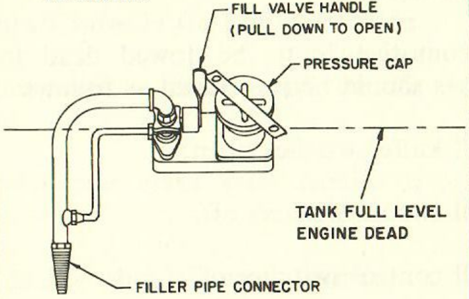

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Fig. 3-5 – Cooling System Pressure Cap And Filler/Relief Arrangement

In instances where danger of freezing is present, the cooling system should be completely drained or have steam admitted. The draining procedure is as follows:

1. Open the drain valve located at the floor in front of the engine. This will drain the engine radiators, water tank, oil cooler, and air compressor.

2. After cooling system pressure has been released and draining has slowed, remove the water tank fill cap to allow faster draining, Fig. 3-5.

SECTION 4

TROUBLE SHOOTING

INTRODUCTION

This section covers operational problems that may occur on the road and suggests action that may be taken by the operator in response to the trouble.

Safety devices automatically protect equipment in case of faulty operation of almost any component. In general this protection is obtained by one of the following methods.

1. Complete shutdown of the diesel engine.

2. Unloading of the diesel engine.

3. Unloading of the diesel engine and restriction to idle engine speed.

Condition	Probable Cause	Suggested Operator's Response
Hot engine light and alarm.	Temporary operating condition.	If temperature does not return to normal in a reasonable time, shut the unit down. Before shutdown, make the following checks. Check cooling water level. Check that shutters are open and fan is operating. If shutters are closed, operate test valve located in the vicinity of the water tank instruction plate. If valve operation opens the shutters, and temperature returns to normal, operation may continue to the nearest maintenance point.

Condition	Probable Cause	Suggested Operator's Response
Hot Engine light on; alarm ringing.	Tunnel or desert operation	No action necessary unless alarm continues for more than a few minutes. If alarm continues, isolate the affected unit. If water level is too low, shut the engine down. If freezing conditions are possible, drain the cooling system in accordance with railroad regulations.

WARNING: If governor low oil plunger trips to shut the engine down, but the crankcase and low water detector buttons remain set, check oil and water levels. If oil level is satisfactory and water level is marginal, the hot oil detector may have tripped. There is no indicator for such a trip except a very hot engine condition. Do not attempt to restart engine. Report engine shutdown circumstances to authorized maintenance personnel.

Condition	Probable Cause	Suggested Operator's Response
Governor Shutdown light on.	Low water due to leak, or low oil due to leak, or crankcase pressure due to cracked piston or bad cylinder seals, or hot oil due to plugged oil cooler.	If shutdown is due to low water, the addition of water may permit continued operation. Otherwise place the isolation switch in ISOLATE position. If freezing conditions are possible drain the cooling system in accordance with the railroad regulations.

WARNING: If crankcase pressure detector has tripped, make no further engineroom inspections. Do not attempt to restart the engine. Isolate the unit. If freezing conditions are possible, drain the cooling system in accordance with railroad regulations.

Condition	Probable Cause	Suggested Operator's Response
Repeated automatic sanding along with load current indicating meter dropping back.	Normal wheel slip correction under severe conditions.	No action required. Do not reduce throttle unless slipping is so severe that lurching threatens to break the train.

Condition	Probable Cause	Suggested Operator's Response
Ground relay light and alarm.	Ground relay action.	Wait at least 10 seconds, then press the ground relay reset button. If two more ground relay actions occur, isolate the unit. If a traction motor fault is the cause of the ground relay action, the locomotive may return independently to the maintenance point, by operating the cutout switch on the circuit breaker panel to cut out the truck containing the defective motor.

WARNING: Do not tow or operate a locomotive unless absolutely sure that all of its wheels rotate freely.

Do not pull cars with a truck cut out. Do not operate at more than half throttle with a truck cut out.

Condition	Probable Cause	Suggested Operator's Response
Alarm bell rings - No warning lights on in lead unit.	Ground relay action in trailing unit.	Same response as above.
	Trailing unit shut down.	Check warning lights in cab of affected unit. If no lights are on, check overspeed lever at accessory end of engine. Reset if required and restart engine. If overspeed occurs again, operation at reduced throttle may prevent the overspeed trip. If not, isolate the unit and allow it to remain shut down.

Condition	Probable Cause	Suggested Operator's Response
Engine does not respond to throttle.	Tripped circuit breaker; Control switches improperly positioned.	Check the control circuit breaker and the engine run switch. Check electrical cable at the engine governor.

Condition	Probable Cause	Suggested Operator's Response
Engine responds to throttle but no power is developed.	Blown fuse.	Check battery field 80-ampere fuse. Open the main battery switch before checking and reinstalling the fuse.
	Control breaker tripped.	Check control circuit breaker.
	Reverser handle centered.	Place reverser handle in an operating position.
	Generator field switch off.	Check position of generator field switch; also check position of isolation switch. Move throttle between IDLE and 1 and check pickup and dropout of generator field contactor BF.

Condition	Probable Cause	Suggested Operator's Response
	Electrical system fault.	With service selector switch in SERIES or ROAD position, and the unit developing no power with throttle at position 1, check position of load regulator. If load regulator is at maximum field position, there is a fault in the excitation system preventing excitation of the main generator. If the load regulator remains at minimum field position, there is a fault in the control circuits.

Condition	Probable Cause	Suggested Operator's Response
PCS light on.	Penalty brake application.	Move throttle to IDLE. Move brake valve handle to handle-off position, and then to release position.
	Emergency brake application.	Move throttle to IDLE position. Move brake handle to emergency position and wait 45 seconds before moving handle to release position. NOTE: Follow railroad regulations after any penalty or emergency brake application.
Intermittent wheel slip light indications.	Normal wheel slip correction under severe conditions.	No action required. Do not reduce throttle unless slipping is so severe that it threatens to break the train.

Condition	Probable Cause	Suggested Operator's Response
Excessive wheel slip light indications.	Locked sliding wheels.	Check that all wheels on the locomotive rotate freely. Do not operate a locomotive unless all wheels rotate freely.
	Control or transmission system fault.	Cut out a pair of traction motors and check operation. If the slipping condition is corrected with a truck cut out, return the unit to a maintenance point.

CAUTION: Do not pull cars with a truck cut out. Make certain that all wheels rotate freely before moving the locomotive.

Do not operate at more than half throttle with a truck cut out.

Condition	Probable Cause	Suggested Operator's Response
Trailing units do not respond to throttle.	Local control breaker tripped in trailing unit.	Reset breaker.
	Jumper cable between units not securely connected.	Secure jumper cable.